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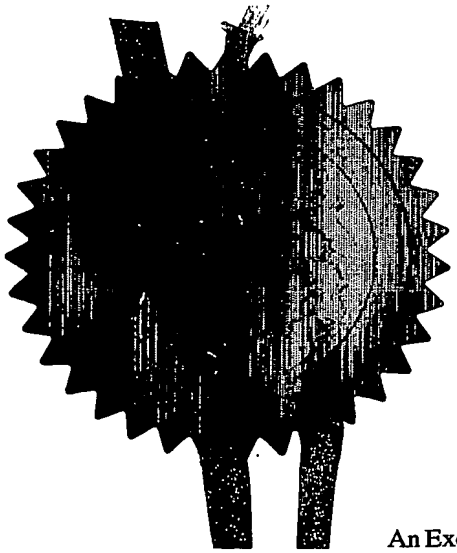

Signed K Behen

Dated 28 October 2003

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1. Your reference — P3060-GB — 0300187.2

2. Patent application number *(The Patent Office will fill in this part)* — 06 JAN 2003 — 06JAN03 E774891-1 D02902 P01/7700 0.00-0300187.2

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

LEWIS, Thomas, John
Unit 4 Astwood Developments
Widesgates
Nr Looe
Cornwall
PL13 1QB

Patents ADP number *(if you know it)* 7600581900 2

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention — A SELF CONTAINED MONITORING CIRCUIT

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

K R Bryer & Co
7 Gay Street
Bath
BA1 2PH

Patents ADP number *(if you know it)* 10777002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
GB	0220970.8	11/09/02

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

NO

a/c 13/1/03

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9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	11
Claim(s)	3 CF
Abstract	
Drawing(s)	4 only

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translation of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	One
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature Date 06/01/03

12. Name and daytime telephone number of person to contact in the United Kingdom BRYER, Kenneth 01225 428877

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A SELF CONTAINED MONITORING CIRCUIT

The present invention relates generally to a self-contained monitoring circuit, and particularly to a device incorporating such a circuit which is capable of monitoring the continuity of supply delivered through an electrical socket.

Electrical monitoring circuits for detecting continuity of supply are known as such. For example, the so-called "uninterruptable power supply" (UPS) devices supplied for computers operate, among other things, to detect a failure in the supply continuity, and to provide a computer with a battery-generated power supply for a limited time period during which the mains power is not available. A signal connection between the UPS and the computer triggers the computer to shut down in its normal "safe" mode. This is necessary because computers operate with electronic data which may be corrupted if the computer is merely switched off whilst operating. UPS devices are substantial in size, of significant expense, and require to be interconnected between the socket outlet of a power supply and a dedicated input of the computer. However, there are other items of equipment for which continuity of electrical supply is of significance, although not of such great significance that it justifies the cost of an expensive monitoring circuit of the UPS type.

For example, a refrigerator or freezer requires continuity of supply in order to maintain its contents in a cool, or frozen, state and although a short interruption in the power supply may not be disastrous, as it may be in the case of a computer, an extended interruption in the power supply could result in the contents of the freezer or

refrigerator warming to such an extent that they become unsafe to use or at least should not be re-frozen.

The present invention seeks to provide a device which is simple and economical, and which, although not providing a back-up power supply in the event of failure or interruption, will nevertheless be capable of alerting a user to the situation so that appropriate remedial action can be taken promptly.

The present invention seeks to provide a device for monitoring the continuity of an electrical power supply, which is capable of producing an alarm indication (either audible or visual) if an unexpected or inadvertent interruption in the power supply should occur whereby to alert a user. This may happen, for example, because the incorrect switch of a bank of power supply switches has been thrown, for example in circumstances where a multiple socket has a number of plugs with connections leading to a number of different consumers. In a domestic environment, for example, a freezer, washing machine, tumble drier and other domestic electric appliances may all be connected to a bank of sockets having associated switches. If, intending to switch off the power supply to a washing machine the switch on the plug leading to the freezer were inadvertently thrown there would be no indication of this error until warming of the freezer contents were noted, by which time it may be too late. The same applies if the mains power supply fails. Usually, however, in such circumstances other electrical appliances such as lighting, heating and radio or television also cease to function providing an indication to alert the user to the circumstance. Moreover, in this case, little, if anything, can be done to mitigate the

consequences. However, the device of the present invention is operable to detect all conditions and provide an output indication if the power supply to a monitored appliance is interrupted for any reason.

In its broadest aspect, therefore, the present invention provides a self-contained alarm device for monitoring the supply status of a monitored electrical appliance, which device can be connected in the supply line from the mains network to the appliance itself, and is operable to provide an audible and/or visible alarm signal if the electrical power to the appliance is interrupted after connection of the device.

In one embodiment of the invention the alarm device is formed as an adapter having electrical pins for insertion into a socket of a mains network, and having socket connections for receiving the pins of a connector plug of the monitored appliance. This embodiment is presently preferred since it can be used at different times for different appliances, is simple to implement and requires no user-input for wiring the device into the system to be monitored. Alternatively, however, the device may be incorporated into a plug for connection to the lead from the appliance. If such plugs are provided by OEM's (originally equipment manufacturers) then, again, no additional work is required by the user, although provision of plugs fitted with such circuit devices for retrofitting to equipment is possible and within the scope of the present invention. In such an embodiment it is preferred that the monitoring circuit is housed in the back of a three-pin plug, with contacts allowing electrical connection to be made to the "live" and "neutral" pins of the plug.

Ideally the circuit device is provided with means for detecting an open-circuit condition of a monitored supply line. This may include a delay timer for delaying activation of an output device triggering the alarm indication for a predetermined delay period after detection thereof. This delay period avoids the emission of spurious or unnecessary alarm indications if, for example, the plug is being withdrawn simply to be repositioned, or if a disconnection effected by throwing the switch is deliberate and temporary. The delay period may be anything from a few seconds to a few minutes, and may be adjustable to allow adaptation of the device to different appliances having different requirements. A delay of an hour or more may be appropriate in some circumstances where a delay of a few seconds is sufficient in others.

Solid state components can be produced in miniaturised form sufficient to enable the device to be fitted into the space available within an electrical plug of conventional dimensions. Electro-mechanical devices may also be incorporated and, for example, the output device in particular may be a relay or a solid state switching device such as a field-effect transistor. The self-contained alarm device may incorporate a capacitor which is maintained charged when the supply is present and which discharges when the supply is removed, whereby to provide a sensing signal detectable by an appropriate detection circuit and usable as the parameter to indicate the interruption of the power supply.

The open circuit condition may be detected, for example, by sensing a reversal in the polarity of a voltage differential across a resistive element.

Various embodiments of the invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of electrical appliances connected to the mains supply via monitoring devices formed as first and second embodiments of the present invention;

Figure 2 is a schematic exploded view of first embodiment of the present invention positioned between an electrical socket outlet and a connector plug for an appliance;

Figure 3 is a schematic circuit diagram of some components of a device formed in accordance with the principles of the present invention;

Figure 4 is a schematic view of a second embodiment of the invention; and

Figure 5 is a schematic circuit diagram of an alternative circuit.

Turning now to the drawings, Figure 1 illustrates a typical situation in which the monitoring device of the present invention may be utilised. Here, a washing machine generally indicated 11 and a domestic freezer generally indicated 12 are connected by respective leads 13,14 to a double outlet socket 15 having respective rocker switches 16, 17 for controlling connection and disconnection of the power supply from a mains network (not illustrated) to respective socket outlets on either side of the switches. The freezer is shown connected to the socket outlet 15 by a plug 19 via the interception of a monitoring device 20 formed as a first embodiment of the invention, having a visible indicator lamp 21 and an audible alarm outlet (microphone or buzzer) 22, and the washing machine 11 is shown connected to the socket outlet 16 by a plug

18 formed as a second embodiment of the invention.

As can be seen in Figure 2, a live pin 23 of the monitoring circuit 20 connects directly to a live pin 24 of the plug 19 which is electrically connected via the load, in this case a freezer 12, to the neutral pin 25 of the plug 19. A sensing circuit 26 of the device 20 is connected between the neutral socket 29 and a neutral pin 27. The sensing circuit 26 is illustrated in more detail in Figure 3. It incorporates a battery 30, typically a nine volt battery, the positive terminal of which is connected to the battery supply rail 31 and the negative terminal of which is connected to ground. The battery supply rail 31 is connected via a resistor 32 and series-connected capacitor 33 to ground and, via a parallel resistor 34 to a balanced input 35 of a timer circuit 36 the other input 37 of which is connected via a line 38 to a node 39 between the sensing resistor 32 and capacitor 33.

The timing circuit 36 is powered from the battery supply rail 31 via a line 40 and has an output line 41 leading to a relay coil 42 the other end of which is grounded. The relay contacts 43 are likewise grounded and the central contact 44 is connected via a line 45 to an audible indicator device 46 supplied from the supply rail 31. A protection diode 42 is connected in a forward direction between ground and the output line 41. A relay coil 50 is connected in series between the socket 19 and the pair 27. Its associated relay contacts 48 are connected between the node 39 and ground.

Finally, a test switch 47 is connected between the node 39 and ground.

When the device 20 is plugged into a socket outlet and a plug 19 is plugged into the device 20 and the main switch 17 thrown to energise the appliance 12 the relay 50 is energised and the contacts 48 open allowing the capacitor 33 to charge. The timer circuit 36 is balanced in these circumstances and the output on line 41 is therefore at ground or, at any rate, a low level such as not to energise the relay coil 42. The movable contact 44 of this relay engages the "open circuit" contact of the contact pair 43 so that no current can flow through the audible indicator 46. If it is desired to test the operation of the circuit the switch 47 is depressed grounding the node 39. The capacitor 43 then discharges rapidly causing a fall in the voltage at the input 37 of the timer 36. This unbalanced situation is detected to cause a positive output on line 41 triggering the relay coil 42 and causing the centre contact 44 to switch to the earthed contact thereby creating a path thorough the audible indicator 46 from the supply rail 31 and through the connecting line 45. The audible indicator thus provides an output sound which, upon release of the switch 47, ceases as the capacitor 33 recharges and the voltage level at input 37 rise to its original value.

If, instead of the test switch 47, the switch 17 is thrown to cause voltage to the appliance to fail, or if the mains power fails or the plug is withdrawn from the socket, the relay contacts 48 close resulting in a similar operation to that of the test button 47, giving an audible alarm to indicate the failure condition and alert the user to the inadvertent (or deliberate) disconnection of the monitored appliance.

As will be seen from Figure 2, the circuit 26 will detect an interruption if the plug 19 is withdrawn from the socket connectors 28, 29 of the device 20, or if the device 20

itself is withdrawn from the supply outlet as well as switching of the circuit via the switch 17. Likewise, failure of the power supply entirely will also produce the same result.

Turning now to the embodiment shown in Figures 4 and 5, the plug 18 has a standard body or base 51 and an enlarged back cover 52 which houses the sensor and alarm circuit illustrated in Figure 5. The base 51 of the plug 18 carries three connector pins in the usual way, comprising an earth pin 53, a live pin 54 and a neutral pin 55. The live pin 54 is connected to a fuse clip 56 within the base 51, which receives a fuse 58 engaged at its other end in a combined fuse clip and connector clamp 59 for receiving and clamping a wire of a cable (not shown) in the usual way.

The neutral pin 55 has a corresponding clamp block 57 within the base 51.

The modified back 52 housing the circuit which will be described in relation to Figure 5 has a contact spring 60 positioned such that when the back 52 is fitted over the base 51 it presses against the contact clamp 59, and a second contact spring 61 is positioned to engage the clamp block 57. Thus, in the assembled position, the contacts 60 and 61 are respectively electrically connected to the live pin 54 and neutral pin 55 so that, when the plug is inserted into a socket they receive the AC high voltage current which also passes from the plug to the appliance being supplied.

As can be seen in Figure 5, the two contact springs 60, 61 comprise the input terminals to the circuit. The terminal 60 is connected via fuse 62 to a diode 63 which

acts, in the usual way, as a half-wave rectifier supplying a positive supply rail 78 of the circuit. The positive supply rail 78 is connected via a suppressor capacitor 64 to the ground rail 79 supplied by the neutral terminal 61.

The half-wave rectified signal from the diode 63 is converted in the power supply circuit 65 to a smoothed DC current which is supplied on two outputs 68, 69 respectively at 15 volts and 5 volts. Biasing resistors 66, 67 across the input of the power supply circuit 65 determine the ratio of the output voltages.

The output voltage from the output 69 is supplied via resistor 73 to the gate of a field effect transistor 74 connected across a capacitor 75 connected between ground and an input 76 disc of a timer circuit 72. A timing input 84 of the timer 77 receives a voltage divided between two resistors 85, 86 the ratio of values of which determines the mark-to-space ratio in the output from the timer 77, which is supplied on line 87. The higher value DC output on line 68 is fed via two main capacitors 71, 72 to the positive biasing input 88 of the timer 77.

The output from the timer 77 is produced on line 87 and controls the operation of a piezo-electric alarm 83 which is connected in parallel with a light-emitting diode 82 having a series resistor 81 between the main DC rail 68 and the control line 87 at the output of the timer circuit 77.

The circuit described above operates as follows: when the back 52 is fitted to the base 51 of the plug 18 the terminals 60,61 engage the pins 54, 55 so that when,

subsequently, the plug 18 is inserted into a socket, alternating current is supplied to these terminals. The half-wave rectified current applied to the input of the power supply circuit 65 gives rise to the DC output as described above on lines 68, 69, which causes steady charging of the capacitors 71, 72 until they are fully charged. At the same time the lower-value voltage on the output line 69 from the power supply circuit 65 fed via the resistor 73 to the gate of the field-effect transistor 74 causes this to be conductive thereby short circuiting the capacitor 75 and maintaining the input 76 at the ground value of the neutral terminal 61. The timer 77 is thus turned off and the output on line 87 is maintained at the 15 volt level applied to the biasing terminal 88 so that no current flows through the light emitting diode 82 or the piezo-electric alarm 83. If, at this point, the power supply across the terminals 60 and 61 should fail, either from a failure in the mains network, or by switching off the switch socket, or even by withdrawal of the plug from the socket, the voltage applied to the power supply circuit 65 falls immediately to zero and the outputs on lines 68 and 69 likewise fall to zero. The field-effect transistor 74 is now rendered non-conductive allowing the capacitor 75 to begin charging through the series resistors 85, 86 from the 15 volt line 68 which, now, is maintained at 15 volts by the capacitors 71, 72. The timer 77 is thus switched on and periodically allows the output voltage on line 87 to fall to the ground value so that the piezo-electric alarm 83 is periodically sounded and the light-emitting diode 82 periodically illuminated. The period is determined by the mark-to-space ratio of the timer 77 which, as mentioned above, is itself determined by the relationship between the values of the biasing resistors 85, 86 at the input to the time 77. Typically this mark-to-space ratio will be 6:1 or more so that as the capacitors 71, 72 gradually discharge through the alarm 83 and light-emitting diode 82 the length of time for

which they remain activated is extended approximately by a factor of 6. It is also significant to note that an intermittent signal is more noticeable by the human ear than a continuous signal so the volume of the acoustic output from the alarm 83 does not have to be very high in order for it to be easily noticeable. The alarm continues to sound until the capacitors 71 and 72 are discharged and thereafter is silenced. However, this alarm is of sufficient duration and intensity to alert the user to a potential failure of the supply to the equipment being supplied through the plug of which the alarm circuit forms part.

CLAIMS

1. A self-contained alarm device for monitoring the supply status of a monitored electrical appliance for connection in the supply line from the network for the appliance, operable to provide an audible and/or visible alarm signal if the electrical power to the appliance is interrupted after connection.

2. A self-contained alarm device according to Claim 1, formed as an adapter with pins for insertion into a socket and having socket connections for receiving the pins of a connector plug of the monitored appliance.

3. A self-contained alarm device according to Claim 1 incorporated into a lug for connection to a mains supply socket.

4. A self-contained alarm device according to Claim 1 or Claim 2, in which there are provided means for detecting an open-circuit condition of a monitored supply line.

5. A self-contained alarm device according to any of Claims 1 to 3, including a delay timer for delaying operation of an output device triggering the alarm indication for a pre-determined delay period after detection thereof.

6. A self-contained alarm device according to Claim4, in which the said output device is a relay.

7. A self-contained alarm device as claimed in any preceding claim, having a capacitor which is maintained charged when the supply is present and which is arranged to discharge when the supply is removed.

8. A self-contained alarm device as claimed in any preceding claim, in which the open circuit condition is detected by sensing a reversal in the polarity of a voltage differential across a resistance element.

9. A self-contained alarm device as claimed in Claim 7 or Claim 8 in which the said capacitors provide the power for an invisible and/or visible alarm indicator upon the occurrence of an alarm condition.

10. A self-contained alarm device as claimed in Claim 9 in which the alarm indicator device is supplied intermittently to give the alarm indication.

11. A self-contained alarm device is claimed in Claim 10 in which the mark-to-space ratio of the alarm signal is determined by the ratio of the values of two series-connected resistors in the input circuit of a timer.

12. A self-contained alarm device as claimed in any of Claims 7 to 11 in which a secondary output form the power supply is applied to the timer circuit to maintain it in a quiescent condition as long as the power is supplied to the circuit.

13. A self-contained alarm device substantially as hereinbefore described with reference to, and as shown in Figures 2 and 3 or 1, 4 and 5 of , the accompanying drawings.

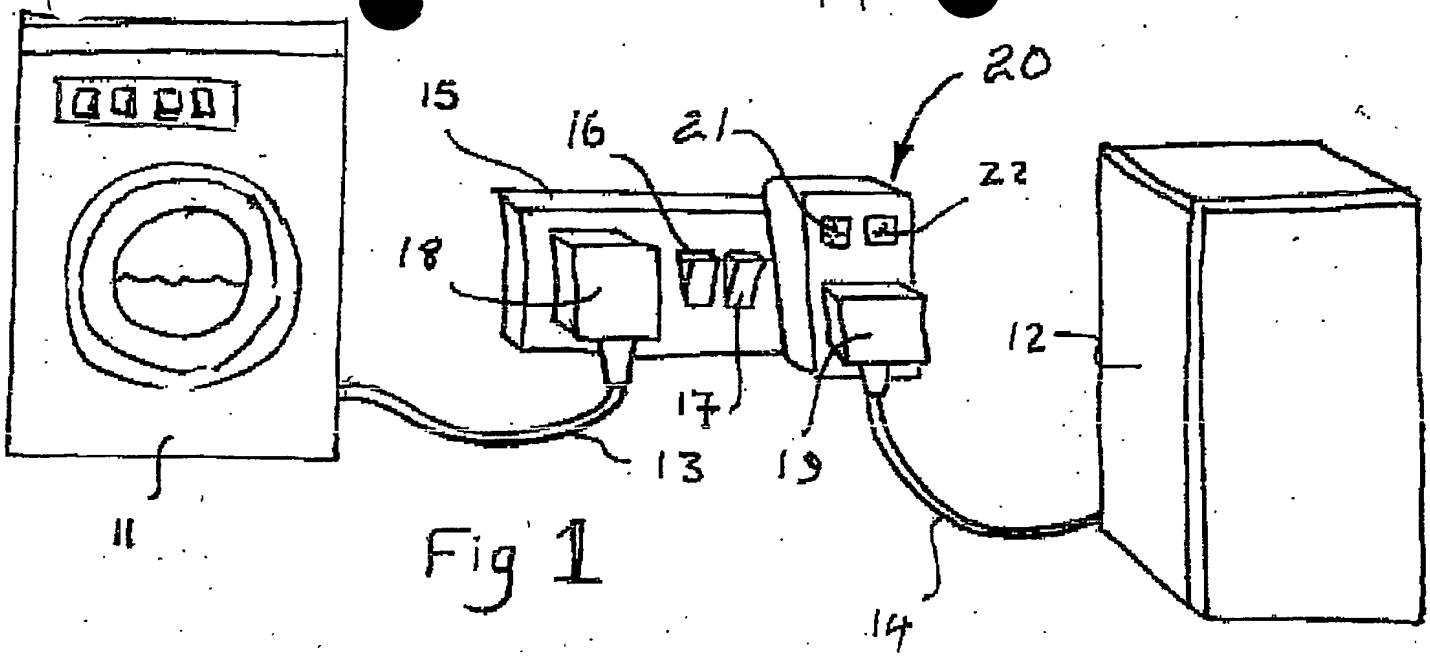

Fig 1

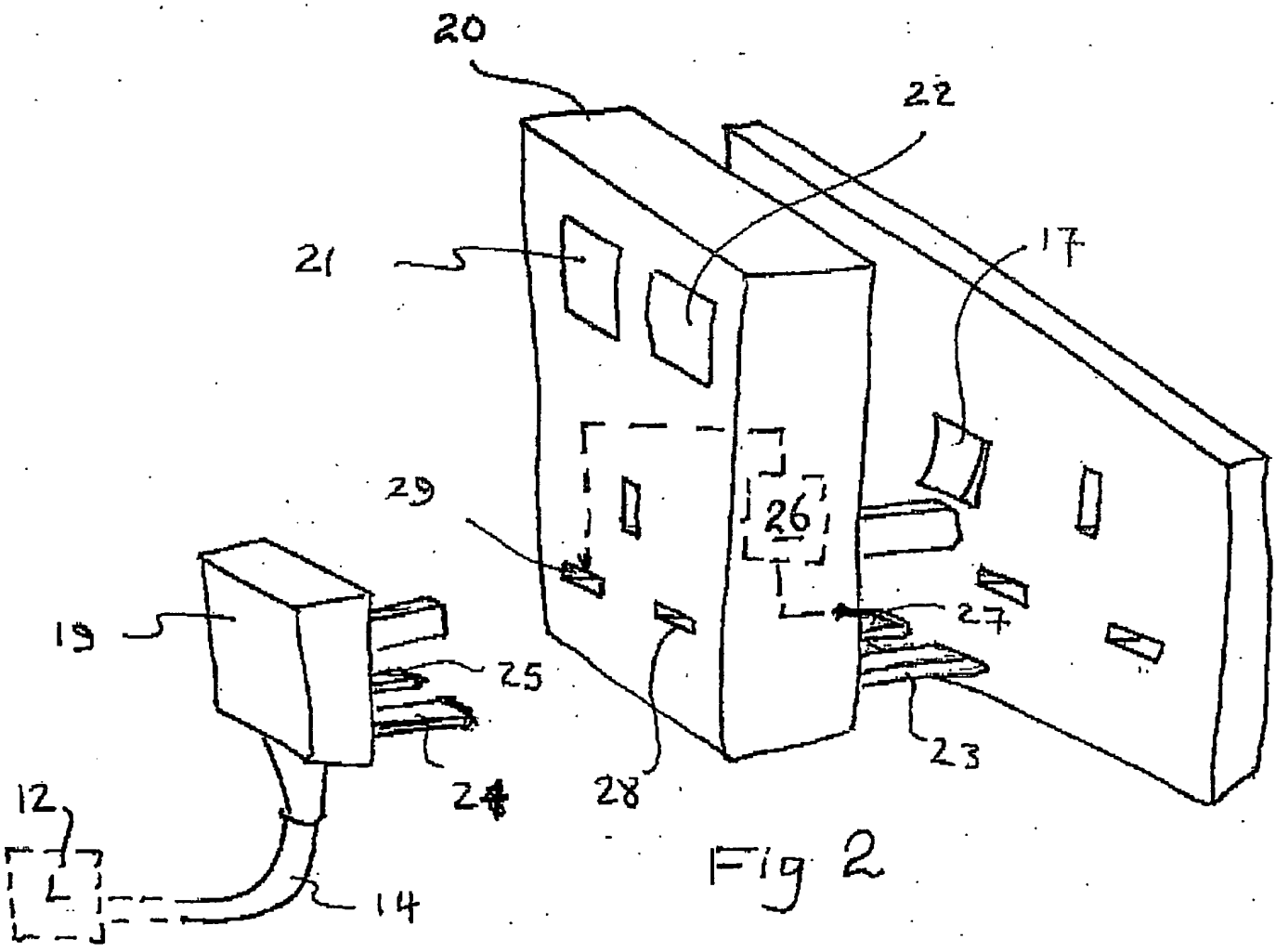

Fig 2

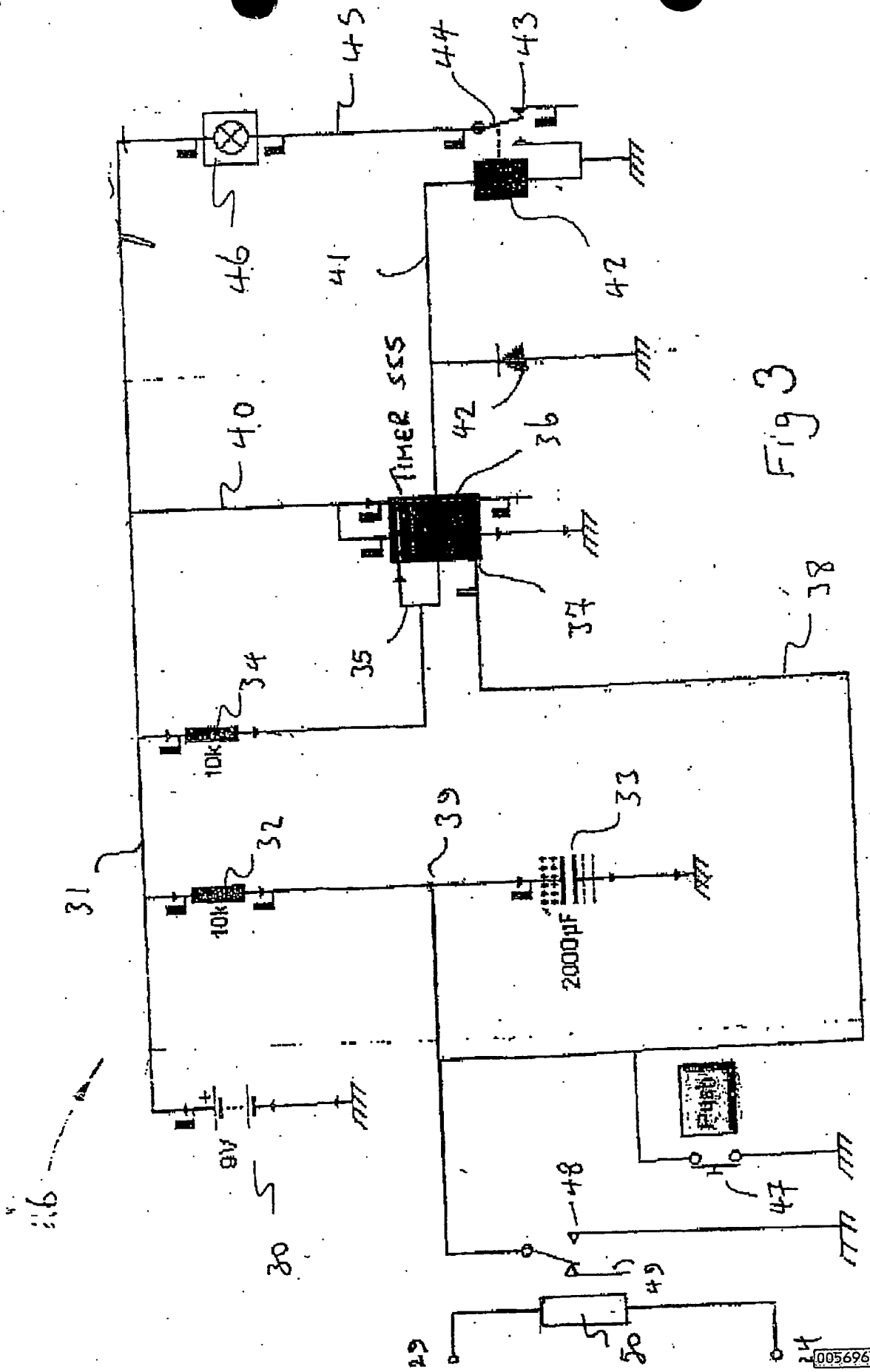

Fig 3

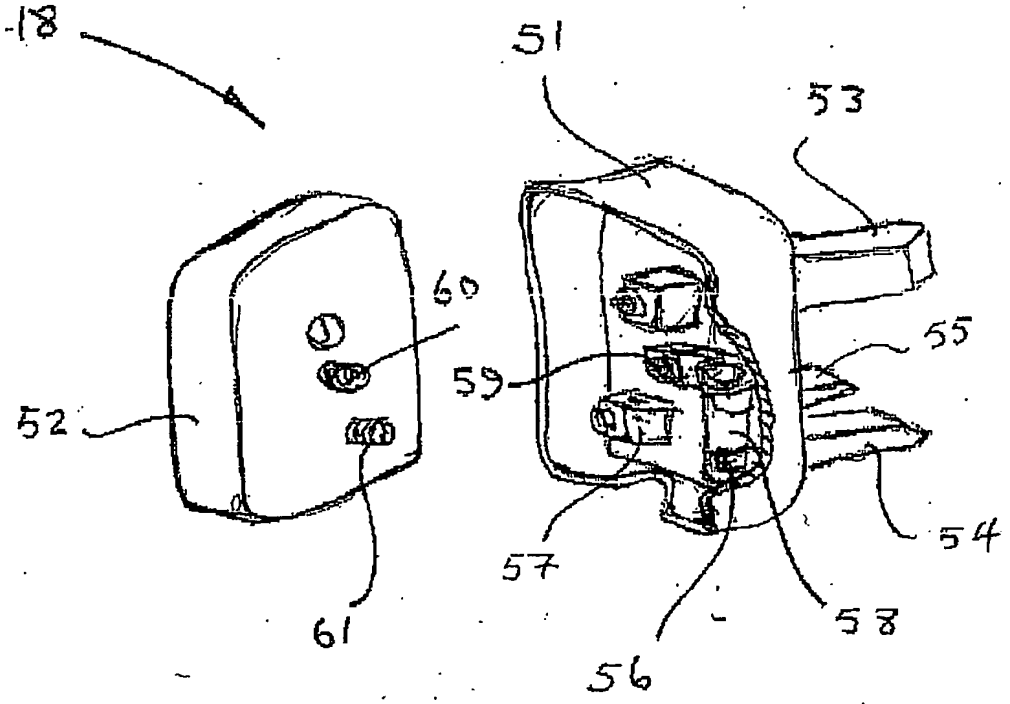

Fig 4

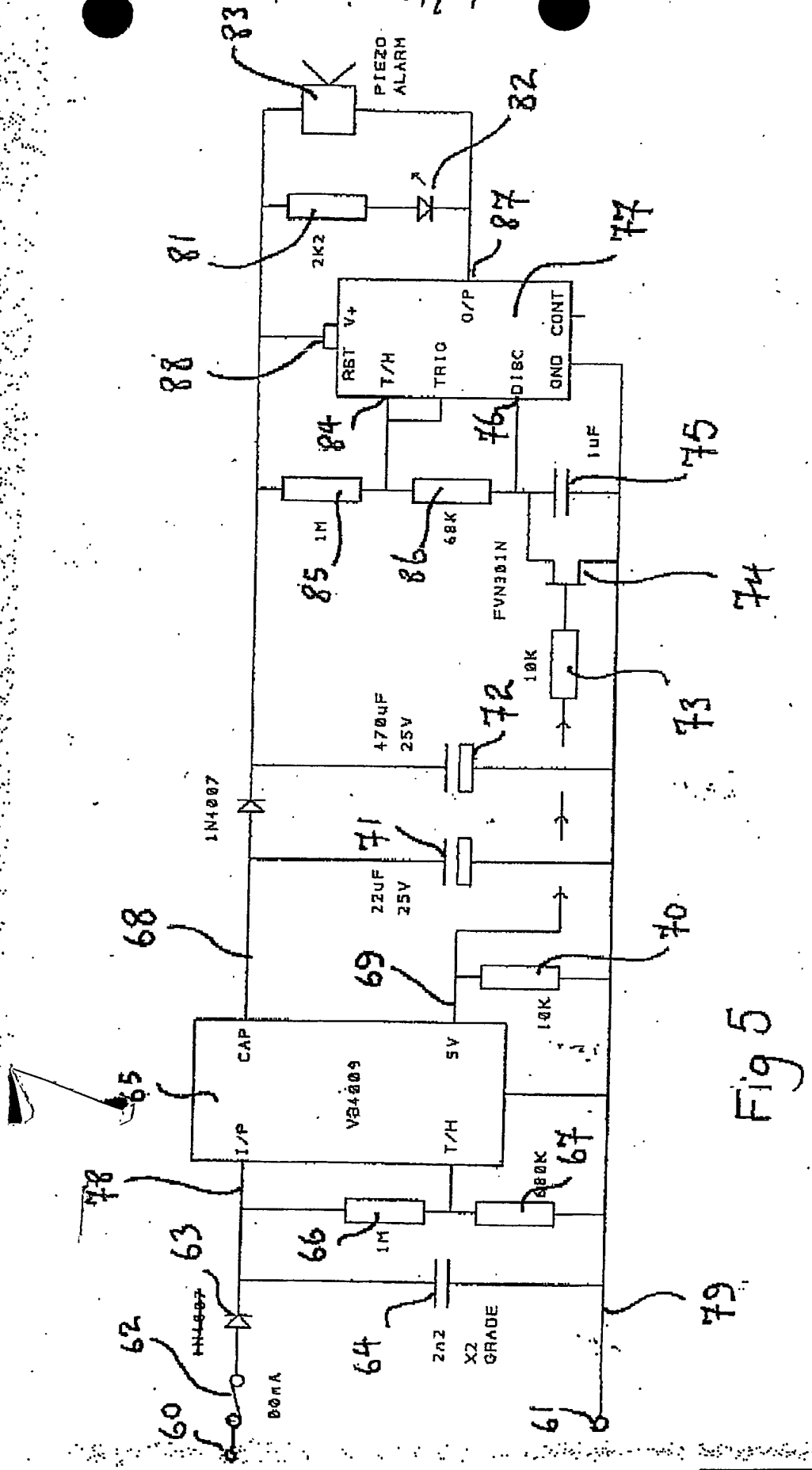

Fig 5